

Gyrokinetic analysis of linear instabilities within the pedestal of experimental discharges

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The pedestal region of a tokamak is the area in which the pressure gradients are highest. This gradient serves as a source of free energy to a large group of instabilities, examples including the ion temperature gradient mode (ITG), trapped electron mode (TEM), kinetic ballooning mode (KB) and electron temperature gradient mode (ETG). Understanding the pedestal height and width is a key component to achieving high core temperatures in a steady state device, which has been a focus of Fusion Energy Science Joint Facilities and Theory Research Target 2011.

Recent advances in GYRO [1] allow simulations to map out the linear stability of many eigenvalues and eigenvectors of the gyrokinetic equation (as opposed to only the most unstable) at low computational cost. In the present work, GYRO's new linear capabilities are applied to the pedestal region of experimental discharges (DIII-D shot 131997 in particular) to determine the nature of all instabilities present. The properties of these instabilities, from the frequency response to structure of the eigenfunctions, are explored through theoretically self-consistent parameter scans.

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[1] Belli et al, Physics of Plasmas **17**, 112314 (2010)